



DLA-97-P70216

# **ECONOMIC ANALYSIS OF CUSTOMER SERVICE CALL CENTER PROJECT**

OCTOBER 1997

FOR

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**DEFENSE LOGISTICS AGENCY  
DEFENSE LOGISTICS SERVICES CENTER**

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BATTLE CREEK, MICHIGAN 49017**

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SERVICE CALL CENTER PROJECT**

**OCTOBER 1997**

**EDWARD PITT**

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**FOREWORD**

This study was requested by the Defense Logistics Services Center (DLSC) at the Battle Creek Federal Center in Battle Creek, Michigan. The request was based on DLSC's need to identify and document the costs associated with its Customer Service Call Center Project and to determine the potential savings and benefits which could be achieved as a result of improving its operations. We are indebted to many persons and organizations for their generous expenditures of time and for their expertise. These include: Bob Prillaman at DSCR; CPT Lou Pieri at DSCC; Dianne Klein at FISC Norfolk; Duane Henderson at CASC; and lastly, the study point of contact, Mike Dickman at DLSC.

  
**JOHN E. FIRTH**  
Colonel, USA  
Chief, DLA Office of Operations Research  
and Resource Analysis

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## EXECUTIVE SUMMARY

Government agencies have been tasked by National Performance Review initiatives to improve service levels and put their customers first. Executive Order 12862 called on government agencies to establish customer service standards in accordance with the best practices in both business and government and to strive to achieve those standards. A benchmarking study report, issued by a federal consortium consisting of some of the best providers of customer service in business, identified the industry's best practices and specified the areas of improvement required to attain the goal of world-class customer telephone service.

The Defense Logistics Agency Materiel Management (DLA-MM) conducted an agency-wide survey of its customer service centers and determined that the Defense Logistics Services Center (DLSC) was the only activity providing satisfactory service to its customers. Subsequently, DLSC was tasked to manage the telephone service improvement program. As part of this initiative, DLSC proposed the collocation and integration of its call center operations with those of the Defense Reutilization and Marketing Service (DRMS) and the Air Force Cataloging and Standardization Center (CASC), which is scheduled to be incorporated into DLA. The purpose of this study was to conduct an economic analysis in order to assist DLSC in the assessment of the costs and potential benefits of the proposed Integrated Call Center Project.

The call center improvement initiative at DLSC is part of an ongoing effort at DLA to achieve the customer service goals of the Executive Branch and to provide for its customers service levels which approach those of the customer satisfaction leaders in the business world. The Defense Logistics Services Center has implemented a plan which will not only reduce the costs of providing superior customer service, but will also provide measurable quantitative benefits to its customers in the form of faster, more efficient service. This improved efficiency will translate into labor and associated cost savings for DLSC, DRMS, and CASC customers.

The analysis in this study indicated a program, which will result in a positive present value on total costs for the planned integrated call center due to the consolidation of resources and streamlining of supervisory positions. In addition, the estimated potential benefits to the call center customers translates into an overall savings to the government, since fewer resources will be obligated to communications between customers and the call center. The present value of the projected cost savings and customer benefits as determined in this study are summarized in the following table.

	5 years	10 years
<b>Call Center Cost Savings</b>	\$104,187	\$4,726
<b>Potential Customer Benefits</b>	\$323,134	\$583,158
<b>Net Present Value of Project</b>	\$427,321	\$587,884

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## **SECTION 1**

### **STUDY DESCRIPTION**

#### **1.1 PROBLEM STATEMENT**

Government agencies have been tasked by National Performance Review initiatives to improve service levels and put their customers first. Executive Order 12862 called on government agencies to establish customer service standards in accordance with the best practices in both business and government and to strive to achieve those standards. A benchmarking study report, issued by a federal consortium consisting of some of the best providers of customer service in business, identified the industry best practices and specified the areas of improvement required to attain the goal of world-class customer telephone service.

The Defense Logistics Agency Materiel Management (DLA-MM) conducted an agency-wide survey of its customer service centers and determined that the Defense Logistics Services Center (DLSC) was the only activity providing satisfactory service to its customers. Subsequently, DLSC was tasked to manage the telephone service improvement program. As part of this initiative, DLSC proposed the collocation and integration of its call center operations with those of the Defense Reutilization and Marketing Service (DRMS) and the Air Force Cataloging and Standardization Center (CASC), which is scheduled to be incorporated into DLA. The purpose of this study was to conduct an economic analysis in order to assist DLSC in the assessment of the costs and potential benefits of the proposed Integrated Call Center Project.

#### **1.2 BACKGROUND**

##### **1.2.1 OVERVIEW**

DLSC, DRMS, and CASC have historically maintained separate call centers that handled incoming requests for information, products, and services. In addition to physical separation, the call centers have maintained separate and exclusive call distribution and data management systems. Each has traditionally been limited in their ability to track performance measures, which, in turn, has hampered efforts to identify and remedy those areas that required improvement in order to provide the best possible service to the ultimate customers.

In accordance with National Performance Review initiatives, independent analysis, and professional consultant recommendations, DLSC has opted to consolidate its customer service operations with those of DRMS and CASC. The consolidation involves physical collocation and system integration in an upgraded facility at the Battle Creek Federal Center.

### **1.2.2 DEFENSE LOGISTICS SERVICES CENTER**

The Defense Logistics Services Center (DLSC), established in 1962, manages information on over 6.2 million supply items used by the federal government. DLSC is responsible for administering the Federal Catalog System (FCS) and uses the Federal Logistics Information System (FLIS) to organize and maintain information from the FCS.

One of the leading products and services DLSC provides for its customers is FED LOG, a searchable database on CD-ROM containing Federal Logistics Data. The DLSC Customer Service Office (CSO) provides customers with assistance in using FED LOG and all DLSC products and services.

### **1.2.3 DEFENSE REUTILIZATION AND MARKETING SERVICE**

The Defense Reutilization and Marketing Service (DRMS) is responsible for the disposal of excess property received from the military services and government agencies. DRMS also manages the Surplus Property Sales program, which sells surplus property to the public that is otherwise not reutilized, transferred or donated. In fiscal year 1996, DRMS managed the disposal of \$4.1 billion worth of property.

### **1.2.4 CATALOGING AND STANDARDIZATION CENTER**

The Air Force Cataloging and Standardization Center (CASC) provides logistics data and program management services, and is responsible for maintaining logistics management data and providing information services in support of Integrated Weapon Systems Management. CASC provides item information, cataloging, and technical services for items managed by the Air Force, and completes logistics maintenance actions for 1.8 million items used throughout the federal government.

### **1.2.5 CHRONOLOGY**

A brief chronology of events associated with the customer service improvement effort follows:

- Executive Order 12862, signed December 1994, mandates that federal agencies develop customer service standards, provide capability to address customer complaints, and "make information, services, and complaint system easily accessible".

- National Performance Review Federal Consortium Benchmark Study Report, February 1995, describes best practices in telephone service and specifies goals for improving service to the American public.
- DLA Materiel Management (MM) conducts baseline customer survey. Inventory Control Point (ICP) commanders conclude that customer telephone service needs significant improvement based on survey results.
- Battelle Team, contracted in March 1995, performs benchmarking study for DLA Supply and Service Centers. Report submitted August 1995 indicates that, based on various performance measures, less than 38 percent of surveyed customers were satisfied with overall DLA telephone service. Only one center, the Defense Logistics Services Center (DLSC), provided "satisfactory" service to its customers.
- DLA-MM tasks DLSC to manage telephone service improvement program.
- December 1995 Commanders Conference establishes Teleservices Improvement Working Group with the following objectives: implement a call center prototype at Defense Supply Center Richmond (DSCR) and a technical pilot at DPSC (C&T); include Defense Depot Regions; develop a plan for other Primary Level Field Activities (PLFAs).
- DSCR call center prototype completed February 1996, three months ahead of schedule. DPSC (C&T) pilot completed July 1996. DCSC/DESC consolidation completed at DSCC, July 1996.
- DLA-MM approves charter and plan, July 1996, providing for uniform method of execution.
- The Federal Systems Integration and Management Center (FEDSIM) approves Project Element Plan for DLSC help desk initiative, October 1996.
- DLSC initiates collocation with Defense Reutilization and Marketing Service (DRMS) customer service operations, November 1996.
- DLSC contracts the Bentley Company to conduct review of DLSC/DRMS and Air Force Cataloging and Standardization Center (CASC) customer service operations.
- Collocation of DLSC and DRMS customer service operations completed, January 1997.
- Bentley Company study report, submitted March 1997, recommends physical collocation and full integration of DLSC, DRMS, and CASC customer service operations. Customer Support Administrative Analysis Team concurs.

- CASC and DRMS commanders approve recommendation to collocate and integrate operations with DLSC, April 1997.
- Bentley Group final report, completed June 1997, outlines implementation plan based on final recommendations for collocation and integration of DLSC, DRMS, and CASC call centers.

### **1.3 OBJECTIVES**

The objectives of this study are listed as follows:

- Identify and quantify costs associated with implementing and maintaining DLSC/DRMS/CASC call center collocation and integration.
- Determine projected costs and customer benefits expected to accrue from the consolidated call center.
- Identify and, where possible, quantify benefits from improved customer service levels.

### **1.4 SCOPE**

The analysis in this study was confined to customer service operations for DLSC, DRMS, and CASC at the Battle Creek Federal Center. Overall project functional guidance was provided by the DLSC Program Manager in Battle Creek, Michigan. Operational analysis was performed by the technical support staff assigned by DORO in Richmond, Virginia.

### **1.5 MAJOR ASSUMPTIONS**

The following is a list of the major assumptions used in this study.

- The proposed staffing structure for the integrated call center consists of 19 customer service representatives. It was assumed that this staffing level would be maintained through the duration of the project.
- A standard call center associate grade structure providing career progression at the GS-5, 7, 9, 11, and 12 levels was proposed in May 1997. It was assumed in the projections of personnel costs for the proposed call center that this grade structure will be approved and implemented.

- Hardware/software upgrades are allocated in the first year of the project. It was assumed that upgrades of comparable hardware/software would occur in the sixth year of the project with negligible salvage values for the replaced equipment.
- Non-recurring costs expended in FY97 were included in the base year calculations for both the current and proposed call center projections and were therefore effectively treated as sunk costs. These expenditures included operational space design, the ACD portion of the telecommunications upgrade, and technical support costs.
- Costs and benefits are expressed in constant dollars and are not adjusted for inflation.
- Present values of costs and benefits were calculated using a 7% discount rate, based on OMB guidelines for constant-dollar projects with unequal benefits.
- Determination of annual call volumes assumed 250 days per year for call center operations.
- Calculation of customer labor hours assumed 260 days per year and 8 hours per day.
- Incoming calls to the CASC help desk have historically been distributed as approximately 60% military and 40% civilian customers. It was assumed that the grade levels and distribution associated with CASC customers approximates the expected call distribution for the integrated DLSC/DRMS/CASC call center.
- Incoming daily call volume measures were collected by the Bentley Group in May 1997. The total average volume was used in this study as the baseline estimate for the expected daily call volume of the collocated call center. Call volume for existing workload is expected to increase each year. Consequently, the sensitivity analysis employed in this study included a 5% annual inflation of call volume to allow for the expected increased business activity for work already being performed. However, the new workload associated with the Cataloging Consolidation and the Central Contractor Registration (CCR) program will likely increase workload significantly. This new mission requirement was not factored into the analysis since this new workload was undefined at the time the study team conducted the analysis.
- Observations of other DoD call centers indicated similar operations. It was therefore assumed for the purposes of this study that performance metrics collected at DSCR and DSCC would serve as valid indicators of improvements achievable at the proposed DLSC/DRMS/CASC call center.



## **1.6 OTHER DoD CALL CENTER INITIATIVES**

### **1.6.1 DEFENSE SUPPLY CENTER RICHMOND**

The Defense Supply Center Richmond (DSCR) manages through its eight product centers the following items: aircraft components; electrical power and distribution equipment; chemical, electrical, and safety products; batteries and motors; photographic, instrumentation, and fabricated products; industrial machinery.

DSCR's new call center, completed on February 26, 1996, has served as the prototype for the DLA customer service initiative. The call center handles customer inquiries ranging from routine stock availability checks to complex tracking of requisitions or transportation documents. Over 22,000 customers are able to use one number, with the incoming calls automatically distributed to the help desk staff. The call center currently receives approximately 450 to 500 calls per day and is staffed by twelve customer service representatives.

The call center improved its average speed of answer (ASA) from 393 seconds in March 1996 to 73 seconds in January 1997. The 320-second decrease represents an 81 percent overall improvement. This improvement benefits both the call center, which is able to process more calls with greater efficiency, and the customers placing the calls. The benefits achieved include increased customer satisfaction due to shorter calls, reduced frustration, and better problem resolution.

### **1.6.2 DEFENSE SUPPLY CENTER COLUMBUS**

The Defense Supply Center Columbus (DSCC) is responsible for the management of 737,000 line items formerly managed by the Defense Construction Supply Center (DCSC) and the 1.1 million electronic items formerly managed by the Defense Electronics Supply Center (DESC). Fiscal year 1996 sales totaled more than \$1.84 billion.

In December 1994, the center installed a Nortel MSL100 digital switch, with an automatic call distribution (ACD) capability of 500 simultaneous calls. Renovation and integration of the DSCC call center was completed on July 1, 1996. The present help desk staff consists of 20 call center representatives and one supervisor.

Between July 1996 and May 1997, the call center received approximately 15,700 calls per month. The call center improved its average speed of answer from 221 seconds in July 1996 to 75 seconds in May 1997, representing a 66% overall improvement. Similarly, the abandon call rate decreased from 27% to 11% over the same period.

### **1.6.3 FLEET AND INDUSTRIAL SUPPLY CENTER NORFOLK**

The Fleet and Industrial Supply Center (FISC) Norfolk is one of eight Navy supply centers responsible for providing logistics support services and products to Navy and other DoD customers. FISC Norfolk provides logistic support for naval shore installations east of the Mississippi River, Atlantic Fleet ships and units, and various overseas military installations.

FISC Norfolk is currently renovating its call center with an expected completion date of September 1997. The Customer Information Center (CIC) will be staffed by 12 customer service representatives. Telecommunications will utilize the AT&T G3R digital switch recently installed at FISC and currently in use at the Battle Creek Federal Center. The CIC will manage call information using Magic Solutions SupportMagic SQL package.

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## SECTION 2

### DLSC CALL CENTER PROJECT

#### 2.1 BACKGROUND

In March 1995, Battelle was contracted to conduct an assessment of telephone customer service operations and procedures at DLA supply and service centers. The results of that study, released in August 1995, rated all DLA call centers, except DLSC, as unsatisfactory in providing telephone customer service. The findings indicated that DLSC was "the only center with a plan for measuring customer satisfaction or service quality". The report also stated that DLSC was "the best customer service provider of the supply or service centers". Based on the conclusions of the Battelle Report and to satisfy Executive Order 12862, DLSC was tasked with managing the agency-wide initiative to improve call center operations.

DLSC subsequently hired the Bentley Company, a private consulting firm with expertise in customer service improvement, to assess current operations and recommend process and equipment improvements. The initial report, completed in March 1997, recommended collocating and integrating the DLSC and DRMS call centers and, if possible, the Air Force CASC help desk, which is also located in at the Battle Creek Federal Center. Based on these recommendations and independent analyses, DLSC developed and implemented a plan to establish a single integrated call center.

Since implementation, the project has proceeded in four phases. In phase one, the DLSC Customer Service Office (CSO) and Freedom of Information (FOI) help desks were physically colocated with the DRMS help desk. In phase two, the call centers were merged administratively and operations were integrated to utilize the Automatic Call Distributor (ACD) installed in April 1997.

The third phase of the project is expected to be completed October 31, 1997. This phase will entail the physical collocation and integration of the CASC call center with the DLSC/DRMS call center. The call center will occupy a renovated space in Building 1 of the Battle Creek Federal Center.

In phase four of the project, DLSC will implement an integrated concept of operations developed by the Bentley Group. Through recommended process improvements, personnel training, and the use of Magic Solutions SupportMagic SQL, a commercial-off-the-shelf (COTS) software package tailored to managing customer information databases in a call center environment, DLSC expects to improve call center performance metrics in its effort to achieve world-class customer service levels.

## 2.2 NON-RECURRING PROJECT COSTS

In the first phase of the integration project, DLSC physically collocated the DRMS customer service center with its own. Concurrent telecommunications upgrades at the Battle Creek Federal Center included installation of an AT&T G3R digital switch. An upgraded Automatic Call Distributor (ACD), installed the following month, afforded the proposed integrated call center adequate ACD capability for its expected call volume.

DLSC retained the services of the Mekus Johnson design firm to develop plans for an expanded office space capable of accommodating at least 20 customer service representatives. The General Services Administration (GSA) will have responsibility for the renovation of the new call center workspace. The project costs expended to date and anticipated for 1997 and 1998 are shown in Table 2-1.

*Table 2-1: Non-Recurring Project Costs*

	1997	1998
Operational Space		
Design	\$12,697	
Building Renovation <sup>1</sup>		\$102,160
Equipment		
Telecommunications <sup>2</sup>	\$43,050	
Furniture <sup>3</sup>		\$62,000
Hardware/Software		\$58,986
Misc <sup>4</sup>		\$2,500
Technical Support		
Private Consultants	\$182,720	
Government Agencies	\$32,725	
<b>Total</b>	<b>\$271,192</b>	<b>\$225,646</b>

<sup>1</sup> Includes new ceiling, carpeting, painting, wall coverings, partition construction, glass viewing wall, electrical service to 20 workstations, cat 5 com and data lines from the com closet to the HVAC ducting to the renovation designed prints, minor relocation of existing equipment that conflicts with DLSC submitted prints.

<sup>2</sup> Includes ACD portion of telecommunications upgrade.

<sup>3</sup> Estimate based on DSCC call center purchases.

<sup>4</sup> Includes LED Map Board.

## 2.3 RECURRING PROJECT COSTS

### 2.3.1 OPERATIONAL SPACE

Both the DLSC/DRMS and CASC call centers currently occupy space in Building 1 of the Battle Creek Federal Center and have a total combined area of 3,488 square feet. The GSA cost to maintain this space is \$38,089 based on the current Building 1 area rate of \$10.92 per square foot. The proposed call center will occupy 4,928 square feet in Building 2 with a total annual GSA cost of \$53,715. The building cost for the proposed call center is \$15,626 over the cost of operations under the current configuration, as shown in Table 2-2.

*Table 2-2: GSA Annual Building Costs*

Organization	Building	GSA Area Rate	Area (sq ft)	GSA Cost
DLSC/DRMS	1	\$10.92	2,450	\$26,754.00
CASC	1	\$10.92	1,038	\$11,334.96
Total			3,488	\$38,088.96
DLSC/DRMS/CASC	2	\$10.90	4,928	\$53,715.20
Cost Difference between Planned and Current Configuration				\$15,626.24

### 2.3.2 PERSONNEL

Current staffing of the collocated DLSC/DRMS call center and the separate CASC help desk requires 25 full time equivalents. The total annual cost for these positions, including fringe benefits, is \$1.25 million. The breakdown by grade level and salary is shown in Table 2-3.

**Table 2-3: Personnel Costs for Current Staffing Structure**

Call Center	Grade/Rank <sup>1</sup>	Base Annual Salary <sup>2</sup>	Extended Annual Salary <sup>3</sup>	FTE	Total Extended Annual Salary
DLSC/DRMS	GS-13	\$60,583	\$80,242	0.3	\$24,073
	GS-11	\$42,509	\$56,303	15.0	\$844,548
	GS-4	\$20,726	\$27,452	0.3	\$8,235
			<b>Subtotal</b>	<b>15.6</b>	<b>\$876,856</b>
CASC	GS-12	\$50,948	\$67,481	1.0	\$67,481
	GS-11	\$42,509	\$56,303	1.0	\$56,303
	GS-9/step 8	\$38,234	\$50,641	0.4	\$20,256
	GS-5	\$23,188	\$30,713	6.0	\$184,275
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
			<b>Subtotal</b>	<b>9.4</b>	<b>\$377,370</b>
			<b>Total</b>	<b>25.0</b>	<b>\$1,254,225</b>

<sup>1</sup> Step 5 used for civilian personnel salaries, unless otherwise indicated.

<sup>2</sup> Rest of U.S. Locality Pay Table (2.97%)

<sup>3</sup> Extended annual salary includes 32.45% fringe benefit factor.

<sup>4</sup> Standard composite rate (without PCS) from AFI 65-503 Cost and Planning Factors, Table A19-1, 12 March 1997.

Fringe benefit cost factors was applied to civilian personnel base salaries in order to determine the extended total annual personnel costs. The 32.45% fringe benefit cost factor used in this analysis was derived from OMB Circular No. A-76, Performance of Commercial Activities, Revised Supplemental Handbook, March 1996. The cost factors for civilian personnel are shown in Table 2-4. The standard composite pay rate for active duty military assigned to the call center was based on AFI 65-503 Cost and Planning Factors. The breakdown of cost elements for grade E-7 is shown in Table 2-5.

**Table 2-4: Fringe Benefit Cost Factors for Federal Civilian Employees**

Standard Retirement (1996 rate)	23.7%
Insurance and Health Benefits	5.6%
Medicare	1.45%
Miscellaneous (workmen's compensation, bonuses and awards, and unemployment programs)	1.7%
<b>Total</b>	<b>32.45%</b>

**Table 2-5: Military Annual Standard Composite Pay for Grade E-7 (without PCS)**

Basic Pay	\$27,309.18
Retired Pay Accrual	\$8,902.79
BAQ/VHA	\$5,289.95
Incentive Special Pay	\$207.01
Miscellaneous	\$7,345.54
<b>Total</b>	<b>\$49,054.47</b>

Proposed streamlining of supervisory positions and reduction of the total number of customer service representatives from 21 to 19 under the collocation plan will reduce staffing levels from 25.0 to 21.5 FTEs. It was assumed that the 0.3 FTE currently required by the GS-13 supervisor for the DLSC/DRMS call center will increase to 1.0 FTE in the collocated call center. The proposed staffing structure will have an annual recurring cost of \$1.08 million, representing a reduction of \$169,396 from the cost of the current staffing structure. The proposed staffing structure and associated costs are shown in Table 2-6.



**Table 2-6: Personnel Costs for Proposed Staffing Structure**

<b>Fiscal Year</b>	<b>Grade/Rank<sup>1</sup></b>	<b>Base Annual Salary<sup>2</sup></b>	<b>Extended Annual Salary<sup>3</sup></b>	<b>FTE</b>	<b>Total Extended Annual Salary</b>
1998	GS-13	\$60,583	\$80,242	1.0	\$80,242
	GS-11	\$42,509	\$56,303	14.0	\$788,244
	GS-5	\$23,188	\$30,713	5.0	\$153,563
	GS-4	\$20,726	\$27,452	0.5	\$13,726
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
			<b>Total</b>	<b>21.5</b>	<b>\$1,084,829</b>

A standard call center associate grade structure providing career progression at the GS-5, 7, 9, 11, and 12 levels was proposed in May 1997. For the purposes of this analysis, it was assumed that the proposed grade structure will be approved and implemented.

Appendix A, Figure A-7 shows the projected call center staffing structure incorporating grade progression beginning in 1998 for customer service representatives at the GS-5 level, and 2000 for representatives currently at the GS-11 level. It was assumed that within grade step increases would occur every two years after achievement of target grade levels. Based on this structure, personnel costs are projected to be \$1,307,612 in 2002 and \$1,388,566 in 2007. Total projected personnel costs for the current and proposed structures, along with projected savings, are summarized in Table 2-7.

**Table 2-7: Projected Personnel Costs 1998-2007**

<b>Fiscal Year</b>	<b>Current</b>	<b>Proposed</b>	<b>Savings</b>
1998	\$1,254,225	\$1,084,829	\$169,396
1999	\$1,254,225	\$1,099,088	\$155,138
2000	\$1,289,618	\$1,184,648	\$104,971
2001	\$1,289,618	\$1,227,740	\$61,878
2002	\$1,325,041	\$1,307,612	\$17,429
2003	\$1,325,041	\$1,307,612	\$17,429
2004	\$1,359,885	\$1,348,099	\$11,786
2005	\$1,359,885	\$1,348,099	\$11,786
2006	\$1,394,730	\$1,388,566	\$6,164
2007	\$1,394,730	\$1,388,566	\$6,164

## 2.4 FORECASTED COSTS AND SAVINGS

Cost of operations were projected for the current organization and staffing structure. The present value of those costs was calculated using a 7% discount rate, based on OMB guidelines for constant-dollar projects with unequal benefits. Under the current organizational structure, the present value of continued operations is \$7.03 million over 5 years and \$11.17 million over 10 years. These figures include the project costs expended in FY97. Appendix A, Figure A-9 shows the projected costs of continued operations under the current staffing structure and physical configuration.

Expenditures in 1997, the base year of the project, were treated as sunk costs and therefore are included in both the current and proposed cost projections. These costs include the design costs for the operational space, the ACD portion of the digital switch installed at the Battle Creek Federal Center, and technical support costs to include private consultants and government agencies. Appendix A, Figure A-10 shows the forecasted costs for the proposed call center. It was assumed that the costs to renovate, furnish, and equip the new workspace will be expended in the first year of the project.

The present value of the cost of the proposed call center is \$6.93 million for 5 years and \$11.16 million for 10 years, using a 7% discount factor. The 5-year present value of the proposed call center costs is \$104,187 lower than the cost of operating the call center under the current staffing structure and configuration. The 10-year present value of cost savings is \$4,726. This reduction in savings over time reflects the increase in personnel costs due to grade level progression within the proposed call center staff. Present values of projected costs and savings are shown in Table 2-8.

***Table 2-8: Present Value of Projected Costs and Savings (7% discount rate)***

	5 years	10 years
<b>Current Call Center Costs</b>	\$7,029,835	\$11,165,180
<b>Proposed Call Center Costs</b>	\$6,925,648	\$11,160,454
<b>Present Value of Savings</b>	\$104,187	\$4,726

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## SECTION 3

### QUANTITATIVE BENEFITS

#### 3.1 CALL DURATION IMPROVEMENTS

Average speed of answer (ASA) is the time elapsed from the receipt of an incoming call to actual connection with a customer service representative or an automatic system. Both DSCR and DSCC improved their ASA significantly on incoming calls. Table 3-1 shows the monthly ASAs for both centers for the 11-month period following call center operations startup.

*Table 3-1: Average Speed of Answer (seconds)*

Month	DSCR	Month	DSCC
Mar-96	393	Jul-96	221
Apr-96	342	Aug-96	152
May-96	239	Sep-96	83
Jun-96	95	Oct-96	101
Jul-96	55	Nov-96	78
Aug-96	69	Dec-96	55
Sep-96	72	Jan-97	65
Oct-96	115	Feb-97	65
Nov-96	68	Mar-97	75
Dec-96	95	Apr-97	66
Jan-97	73	May-97	75
<b>Improvement</b>	<b>320</b>	<b>Improvement</b>	<b>146</b>

Both centers achieved a monthly ASA of 70 to 75 seconds eleven months after startup. For DSCR, this represented an overall improvement of 320 seconds, or 5.3 minutes. DSCC, starting from a more favorable position, reduced its ASA by 146 seconds, or 2.4 minutes. The average reduction for the two centers was 233 seconds.

### 3.2 LABOR HOUR SAVINGS

Reduced call length offers potential labor savings to government customers directly involved in telephonic communication with the help desk. It was assumed that the proposed DLSC/DRMS/CASC integrated call center could achieve an average reduction in call length of 233 seconds per call based on the improvements in ASA observed at DSCR and DSCC. The expected labor hour savings to the government associated with this activity are shown in Table 3-2.

*Table 3-2: Potential Labor Hour Savings for Call Center Customers*

	CASC	DLSC CSO <sup>1</sup>	DLSC FOI <sup>2</sup>	DRMS	Total
Daily Call Volume <sup>3</sup>	92.8	109.8	63.6	57.2	323.4
Weekly Call Volume <sup>4</sup>	464	549	318	286	1,617
Annual Call Volume <sup>5</sup>	23,200	27,450	15,900	14,300	<b>80,850</b>
Customer Labor Savings <sup>6</sup>					
Seconds/Year	5,405,600	6,395,850	3,704,700	3,331,900	18,838,050
Hours/Year	1,502	1,777	1,029	926	<b>5,233</b>

<sup>1</sup> DLSC Customer Service Office

<sup>2</sup> DLSC Freedom of Information Office

<sup>3</sup> Bentley Report, 30 June 1997.

<sup>4</sup> 5 days/week

<sup>5</sup> 50 weeks/year

<sup>6</sup> Based on average call duration improvement of 233 seconds/call.

### 3.3 DOLLAR SAVINGS

Customer time and resources consumed by telephone communications are unavailable for actual mission requirements. Reducing the time, and therefore customer labor hours, devoted to communications with the call center offers potential savings to the government. The dollar savings associated with reduced labor hours were determined by applying the standard hourly rates of typical customer grade levels to the anticipated reduction in call length.

Approximately 60% of the incoming calls to CASC are from military personnel, with the typical grade ranging from E-2 to E-5. The remaining 40% consist of federal civilian personnel, with the typical grade ranging from GS-7 to GS-9.

Due to a lack of adequate insight into the characteristics of DLSC/DRMS customers, it was assumed for the purposes of this analysis that the grade levels and military/civilian ratio associated with CASC customers approximates the expected call distribution for the integrated DLSC/DRMS/CASC call center.

*Table 3-3: Hourly Labor Rates for Call Center Customers*

Customer	Grade	Basic Annual Rate	Total Annual Rate <sup>1</sup>	Total Hourly Rate <sup>2</sup>
Military	E-2	\$12,033.19	\$23,486.74	\$11.29
	E-5	\$19,539.02	\$37,982.96	\$18.26
			<b>Average</b>	<b>\$14.78</b>
Civilian	GS-7	\$28,720.00	\$38,039.64	\$18.29
	GS-9	\$35,133.00	\$46,533.66	\$22.37
			<b>Average</b>	<b>\$20.33</b>

<sup>1</sup> Total annual composite rate (including PCS) used for military personnel. Fringe benefit cost factor of 32.45% applied to civilian base pay.

<sup>2</sup> Assumes 260 days per year and 8-hour days.

It was assumed that incoming calls are approximately equally distributed between grade levels for both military and civilian customers. Therefore, the average hourly rate for military customers was calculated as  $(\$11.29 + \$18.26)/2 = \$14.78$ , and  $(\$18.29 + \$22.37)/2 = \$20.33$  for civilian customers. Applying these rates to the appropriate call volume proportion yielded the potential customer dollar savings shown in Table 3-4.

**Table 3-4: Potential Dollar Savings for Call Center Customers**

	CASC	DLSC CSO	DLSC FOI	DRMS	Total
Total annual call volume	23,200	27,450	15,900	14,300	80,850
Total customer labor savings (hours)	1,502	1,777	1,029	926	5,233
Calls from military personnel <sup>1</sup>	13,920	16,470	9,540	8,580	48,510
Customer labor savings (hours)	901	1,066	617	555	3,140
Customer dollar savings <sup>2</sup>	\$13,313	\$15,751	\$9,124	\$8,206	<b>\$46,393</b>
Calls from civilian personnel <sup>3</sup>	9,280	10,980	6,360	5,720	32,340
Customer labor savings (hours)	601	711	412	370	2,093
Customer dollar savings <sup>4</sup>	\$12,211	\$14,448	\$8,369	\$7,526	<b>\$42,553</b>
Total customer dollar savings	\$25,523	\$30,199	\$17,492	\$15,732	<b>\$88,946</b>

<sup>1</sup> 60% of total.

<sup>2</sup> Based on \$14.78 hourly labor rate for military customers.

<sup>3</sup> 40% of total.

<sup>4</sup> Based on \$20.33 hourly labor rate for civilian customers.

It was assumed that 50% of the total potential savings could be achieved in the first year of operations and that the full potential savings would be achieved thereafter. Based on this estimated customer dollar savings, the present value of the total potential customer benefits over 5 years is \$323,134, and \$583,158 over 10 years using a 7% discount rate. Adding the potential customer benefits with the expected cost savings for the proposed call center yielded a net present value for all costs and benefits of \$427,321 for 5 years and \$587,884 for 10 years. Present values of cost savings and benefits are summarized in Table 3-5.

**Table 3-5: Present Value of Projected Cost Savings and Benefits (7% discount rate)**

	<b>5 years</b>	<b>10 years</b>
<b>Call Center Cost Savings</b>	\$104,187	\$4,726
<b>Potential Customer Benefits</b>	\$323,134	\$583,158
<b>Net Present Value</b>	\$427,321	\$587,884

### **3.4     SENSITIVITY ANALYSIS**

Sensitivity analysis was conducted by varying the expected call duration improvement and call volume assumptions. In the "low" case, the anticipated call duration improvement of 233 seconds was reduced by 25% to 175 seconds. In addition, the expected average call volume was decrease by 5% annually. Using the previously stated assumptions for achievable benefits based on labor hour requirements, the present value of the potential benefits for 5 years is \$207,170 and \$337,805 for 10 years. The net present value of the project, assuming cost savings do not fluctuate, is \$311,357 for 5 years and \$342,531 for 10 years.

The "high" case assumes a call length improvement of 291 seconds, 25% higher than the base case improvement of 233 seconds. It was also assumed that call volume would increase 5% annually. The resulting present value of benefits is \$471,014 and \$949,271 for 5 and 10 years, respectively. The net present value of the project, assuming costs remain the same, is \$575,202 for 5 years and \$953,997 for 10 years. Results are summarized in Table 3-6.



**Table 3-6: Sensitivity Analysis**

	<b>Low</b>	<b>Base</b>	<b>High</b>
<b>Call Duration Improvement (seconds)</b>	175	233	291
<b>Call Volume Change</b>	-5%	-	+5%
<b>Present Value of Potential Benefits</b>			
<b>5 years</b>	\$207,170	\$323,134	\$471,014
<b>10 years</b>	\$337,805	\$583,158	\$949,271
<b>Net Present Value of Project</b>			
<b>5 years</b>	\$311,357	\$427,321	\$575,202
<b>10 years</b>	\$342,531	\$587,884	\$953,997

## SECTION 4

### QUALITATIVE BENEFITS

#### 4.1 CUSTOMER SATISFACTION

Labor hours and dollars saved contribute significantly to increasing customer satisfaction at the organization level. As previously shown, collective savings for government customers can be realized due to the expected reduction in call duration if the proposed call center plan is fully implemented.

Beyond sheer cost benefits, improvements in ASA as well as other customer satisfaction indicators contribute to the goal of providing the best possible service, and eventually world-class service, to the individual customer. Delays, difficulties, and subsequent frustrations associated with gathering needed information and services can negatively impact the mission readiness and effectiveness of a customer's organization or unit. Improvements on the various customer service metrics serve as indicators of the overall customer satisfaction level.

In addition to ASA, two of the metrics commonly used to measure call center performance are:

- Abandon Rate (Percent Calls Abandoned)
- First Call Resolution (Percent Problem Closed on First Call)

These metrics provide the call center a means of tracking its performance and identifying those areas that require improvement in order to increase customer satisfaction.

## 4.2 ABANDON RATE

Improvements in abandon rates have been achieved at the DSCR and DSCC call centers since startup, and similar improvements can be expected once the DLSC, DRMS, and CASC call centers are collocated and fully integrated. The abandon rate is defined as the percentage of total calls that are terminated by the customer while waiting for service. Abandon rate is usually related to the ASA: the longer a customer is required to wait to be served the greater the likelihood that the customer will abandon the call in frustration.

DSCR improved its abandon rate from 42% to 13% over the 11-month period resulting in 29% fewer total calls abandoned. From July 1996 to May 1997, DSCC reduced its abandon rate from 27% to 11%. Table 4-1 shows the monthly abandoned call rates for DSCR and DSCC during the 11-month period after startup.

*Table 4-1: Abandon Rate (Percent of Total Calls)*

Month	DSCR	Month	DSCC
Mar-96	42%	Jul-96	27%
Apr-96	38%	Aug-96	20%
May-96	34%	Sep-96	13%
Jun-96	18%	Oct-96	13%
Jul-96	13%	Nov-96	11%
Aug-96	13%	Dec-96	9%
Sep-96	15%	Jan-97	9%
Oct-96	17%	Feb-97	10%
Nov-96	12%	Mar-97	10%
Dec-96	17%	Apr-97	10%
Jan-97	13%	May-97	11%

Abandon rate serves as a measure of the quality of service delivered to the customer and therefore improvements in this metric generally coincide with overall improvement in customer satisfaction. There are also potential quantitative benefits associated with abandon rate. When a customer abandons a call, that individual is forced to attempt to establish contact with a customer service agent at a later time. Customers in this situation essentially double or perhaps triple the time they must dedicate to communications with the call center. Improvements in abandon rate would therefore benefit customers by reducing the time and resources consumed by this activity.

### 4.3 FIRST CALL RESOLUTION

First call resolution measures the percentage of calls that are completed by a single customer service representative and do not require transfer to another agent. While ASA and abandon rate are dependent on the telecommunications systems in place, first call resolution mostly relies on the knowledge level and training of the customer service representatives and their ability to readily access the information needed to resolve customer problems and inquiries. Table 4-2 shows first call resolution data for DSCR and DSCC.

*Table 4-2: First Call Resolution*

Month	DSCR	DSCC
Oct-96	69%	72%
Nov-96	66%	71%
Dec-96	72%	69%
Jan-97	70%	69%
Feb-97	71%	68%
Mar-97	-	72%
Apr-97	89%	72%
May-97	90%	73%

In March 1997, DSCR upgraded its telecommunications to utilize Meridian Max as its automated call distributor (ACD). Subsequently, the call center changed how it measured first call resolution. Calls were previously counted as unresolved if the customer service agent put the customer on hold and contacted another agent or supervisor for assistance. The measurement change more accurately represented this metric by counting a call as unresolved only after the agent either released the call or transferred the call to another party. The apparent improvement in the call center's first call resolution from 71% in February 1997 to 89% in April 1997 is attributed to this measurement change.

In April 1997, DSCR began implementation of Magic Solutions Support Magic SQL, a highly rated commercial-off-the-shelf (COTS) software package tailored to the management of customer and information databases as applied to call center operations. Sophisticated information management software packages such as Magic Solutions allow a call center ready access to customer information and call history, enabling the representative to instantly search for related information in order to facilitate problem resolution. The call center is better able to track customer problems and manage follow-up to customer inquiries.

DSCR is currently utilizing Support Magic to build customer databases that will facilitate future customer service. Using this application, the center can track the percentage of calls by type. Call types include customer orders, status inquiries, and requests for points of contact. The flexibility and expandability of the COTS package will eventually allow the service agent to access external databases providing ready access to the information needed to resolve the call and fully serve the customer. DSCR expects to consequently improve the satisfaction level of its customers and to see associated improvements in performance metrics such as first call resolution.

DSCC has in place a call center management information system (CCMIS) which tracks metrics such as hold time status (ASA), abandon rate, and first call resolution, but currently lacks an integrated COTS package to manage customer information. The percentage of calls resolved on the first call remained relatively stable for DSCC between October 1996 and May 1997.

## **SECTION 5**

### **CONCLUSIONS**

The DLSC call center improvement initiative is part of an ongoing effort at DLA to achieve the customer service goals of the Executive Branch and to provide for its customers service levels which approach those of the customer satisfaction leaders in the business world. The Defense Logistics Services Center has implemented a plan which will not only reduce the costs of providing superior customer service, but will also provide measurable quantitative benefits to its customers in the form of faster, more efficient service. This improved efficiency will translate into labor and associated cost savings for DLSC, DRMS, and CASC customers.

The analysis in this study indicated a program that will result in a positive present value on total costs for the planned integrated call center due to the consolidation of resources and streamlining of supervisory positions. In addition, the estimated potential benefits to the call center customers translates into an overall savings to the government, since fewer resources will be obligated to communications between customers and the call center.

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## SECTION 6

### REFERENCES

AFI 65-503, Cost and Planning Factors, Table A19-1, 12 March 1997.

DLA Instruction 7041.1, Economic Analysis, 31 March 1997.

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*DLSC Help Desk Project: Planning for World Class Service*, The Bentley Company, 24 March 1997.

*Defense Logistics Services Center Customer Support Call Center Project Detail Design*, The Bentley Group, 30 June 1997.

*Serving the American People: Best Practices in Telephone Service*, National Performance Review, Federal Consortium, Benchmarking Study Report, February 1995.

*Study of DLA Supply and Service Centers Telephone Customer Service Operations and Systems with Recommended Alternatives for Improvement*, DLA600-94-X-0014, Battelle, 15 August 1995.

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**APPENDIX A**

**PROJECT COSTS**

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**Figure A-1: Non-Recurring Project Costs for Proposed DLSC/DRMS/CASC Call Center**

<b>Project Year</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>6</b>
<b>Fiscal Year</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2003</b>
Operational Space				
Design	\$12,697			
Building Renovation <sup>1</sup>		\$102,160		
Equipment				
Telecommunications <sup>2</sup>	\$43,050			
Furniture <sup>3</sup>		\$62,000		
Hardware/Software <sup>4</sup>		\$58,986		\$58,986
Misc <sup>5</sup>		\$2,500		
Technical Support				
Private Consultants	\$182,720			
Government Agencies	\$32,725			
<b>Total</b>	<b>\$271,192</b>	<b>\$225,646</b>	<b>\$0</b>	<b>\$58,986</b>

<sup>1</sup> Includes new ceiling, carpeting, painting, wall coverings, partition construction, glass viewing wall, electrical service to 20 workstations, cat 5 com and data lines from the com closet to the HVAC ducting to the renovation designed prints, minor relocation of existing equipment that conflicts with DLSC submitted prints.

<sup>2</sup> Includes ACD portion of telecommunications upgrade.

<sup>3</sup> Estimate based on DSCC purchases.

<sup>4</sup> Assumes hardware/software upgrade in 6th year of project.

<sup>5</sup> Includes LED Map Board.

**Figure A-2: Government Services Administration (GSA) Annual Building Costs**

<b>Call Center</b>	<b>Building No.</b>	<b>GSA Area Rate<sup>1</sup></b>	<b>Area (sq ft)</b>	<b>GSA Cost</b>
DLSC/DRMS	1	\$10.92	2,450	\$26,754.00
CASC	1	\$10.92	1,038	\$11,334.96
		<b>Total</b>	<b>3,488</b>	<b>\$38,088.96</b>
DLSC/DRMS/CASC	2	\$10.90	4,928	\$53,715.20
		<b>Increase</b>	<b>1,440</b>	<b>\$15,626.24</b>

<sup>1</sup> Based on current rates for the Battle Creek Federal Center.

**Figure A-3: Personnel Costs for Current Staffing Structure**

Call Center	Grade/Rank <sup>1</sup>	Base Annual Salary <sup>2</sup>	Extended Annual Salary <sup>3</sup>	FTE	Total Extended Annual Salary
DLSC/DRMS	GS-13	\$60,583	\$80,242	0.3	\$24,073
	GS-11	\$42,509	\$56,303	15.0	\$844,548
	GS-4	\$20,726	\$27,452	0.3	\$8,235
			Subtotal	15.6	\$876,856
CASC	GS-12	\$50,948	\$67,481	1.0	\$67,481
	GS-11	\$42,509	\$56,303	1.0	\$56,303
	GS-9/step 8	\$38,234	\$50,641	0.4	\$20,256
	GS-5	\$23,188	\$30,713	6.0	\$184,275
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
			Subtotal	9.4	\$377,370
<b>Total</b>				<b>25.0</b>	<b>\$1,254,225</b>

<sup>1</sup> Step 5 used for civilian personnel salaries, unless otherwise indicated.

<sup>2</sup> Rest of U.S. Locality Pay Table (2.97%)

<sup>3</sup> Extended annual salary includes 32.45% fringe benefit factor.

<sup>4</sup> Standard composite rate (without PCS) from AFI 65-503 Cost and Planning Factors, Table A19-1, 12 March 1997.

**Figure A-4: Fringe Benefit Cost Factors for Federal Civilian Employees**

<u>Cost Factor</u>	<u>Percent</u>
Standard Retirement (1996 rate)	23.7%
Insurance and Health Benefits	5.6%
Medicare	1.45%
Miscellaneous (workmen's compensation, bonuses, awards, unemployment programs)	1.7%
<b>Total</b>	<b>32.45%</b>

**Figure A-5: Military Annual Standard Composite Pay for Grade E-7 (without PCS)**

Basic Pay	\$27,309.18
Retired Pay Accrual	\$8,902.79
BAQ/VHA	\$5,289.95
Incentive Special Pay	\$207.01
Miscellaneous	\$7,345.54
<b>Total</b>	<b>\$49,054.47</b>

**Figure A-6: Projected Personnel Costs for Current Staffing Structure**

<b>1998/1999</b>		<b>Base</b>	<b>Extended</b>		<b>Total Extended</b>
<b>Call Center</b>	<b>Grade/Rank<sup>1</sup></b>	<b>Annual Salary<sup>2</sup></b>	<b>Annual Salary<sup>3</sup></b>	<b>FTE</b>	<b>Annual Salary</b>
DLSC/DRMS	GS-13	\$60,583	\$80,242	0.3	\$24,073
	GS-11	\$42,509	\$56,303	15.0	\$844,548
	GS-4	\$20,726	\$27,452	0.3	\$8,235
			Subtotal	15.6	\$876,856
CASC	GS-12	\$50,948	\$67,481	1.0	\$67,481
	GS-11	\$42,509	\$56,303	1.0	\$56,303
	GS-9/step 8	\$38,234	\$50,641	0.4	\$20,256
	GS-5	\$23,188	\$30,713	6.0	\$184,275
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
			Subtotal	9.4	\$377,370
<b>Total</b>				<b>25.0</b>	<b>\$1,254,225</b>

<b>2000/2001</b>		<b>Base</b>	<b>Extended</b>		<b>Total Extended</b>
<b>Organization</b>	<b>Grade/Rank<sup>1</sup></b>	<b>Annual Salary<sup>2</sup></b>	<b>Annual Salary<sup>3</sup></b>	<b>FTE</b>	<b>Annual Salary</b>
DLSC/DRMS	GS-13/step 6	\$62,365	\$82,602	0.3	\$24,781
	GS-11/step 6	\$43,759	\$57,959	15.0	\$869,382
	GS-4/step 6	\$21,336	\$28,260	0.3	\$8,478
			Subtotal	15.6	\$902,641
CASC	GS-12/step 6	\$52,447	\$69,466	1.0	\$69,466
	GS-11/step 6	\$43,759	\$57,959	1.0	\$57,959
	GS-9/step 9	\$39,267	\$52,009	0.4	\$20,804
	GS-5/step 6	\$23,870	\$31,616	6.0	\$189,695
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
			Subtotal	9.4	\$386,978
<b>Total</b>				<b>25.0</b>	<b>\$1,289,618</b>

<b>2002/2003</b>		<b>Base</b>	<b>Extended</b>		<b>Total Extended</b>
<b>Organization</b>	<b>Grade/Rank<sup>1</sup></b>	<b>Annual Salary<sup>2</sup></b>	<b>Annual Salary<sup>3</sup></b>	<b>FTE</b>	<b>Annual Salary</b>
DLSC/DRMS	GS-13/step 7	\$64,147	\$84,963	0.3	\$25,489
	GS-11/step 7	\$45,010	\$59,616	15.0	\$894,236
	GS-4/step 7	\$21,946	\$29,067	0.3	\$8,720
			Subtotal	15.6	\$928,445



CASC	GS-12/step 7	\$53,946	\$71,451	1.0	\$71,451
	GS-11/step 7	\$45,010	\$59,616	1.0	\$59,616
	GS-9/step 10	\$40,300	\$53,377	0.4	\$21,351
	GS-5/step 7	\$24,553	\$32,520	6.0	\$195,123
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
	Subtotal			9.4	\$396,595

**Total 25.0 \$1,325,041**

2004/2005		Base	Extended		Total Extended
Organization	Grade/Rank <sup>1</sup>	Annual Salary <sup>2</sup>	Annual Salary <sup>3</sup>	FTE	Annual Salary
DLSC/DRMS	GS-13/step 8	\$65,929	\$87,323	0.3	\$26,197
	GS-11/step 8	\$46,260	\$61,271	15.0	\$919,071
	GS-4/step 8	\$22,556	\$29,875	0.3	\$8,963
	Subtotal			15.6	\$954,230
CASC	GS-12/step 8	\$55,444	\$73,436	1.0	\$73,436
	GS-11/step 8	\$46,260	\$61,271	1.0	\$61,271
	GS-9/step 10	\$40,300	\$53,377	0.4	\$21,351
	GS-5/step 8	\$25,235	\$33,424	6.0	\$200,543
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
	Subtotal			9.4	\$405,655
	<b>Total</b>			<b>25.0</b>	<b>\$1,359,885</b>

2006/2007		Base	Extended		Total Extended
Organization	Grade/Rank <sup>1</sup>	Annual Salary <sup>2</sup>	Annual Salary <sup>3</sup>	FTE	Annual Salary
DLSC/DRMS	GS-13/step 9	\$67,710	\$89,682	0.3	\$26,905
	GS-11/step 9	\$47,510	\$62,927	15.0	\$943,905
	GS-4/step 9	\$23,166	\$30,683	0.3	\$9,205
	Subtotal			15.6	\$980,015
CASC	GS-12/step 9	\$56,943	\$75,421	1.0	\$75,421
	GS-11/step 9	\$47,510	\$62,927	1.0	\$62,927
	GS-9/step 10	\$40,300	\$53,377	0.4	\$21,351
	GS-5/step 9	\$25,917	\$34,327	6.0	\$205,962
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
	Subtotal			9.4	\$414,716
	<b>Total</b>			<b>25.0</b>	<b>\$1,394,730</b>

**Figure A-7: Projected Personnel Costs for Proposed Staffing Structure in Collocated DLSC/DRMS/CASC Call Center**

<b>Fiscal Year</b>	<b>Grade/Rank<sup>1</sup></b>	<b>Base Annual Salary<sup>2</sup></b>	<b>Extended Annual Salary<sup>3</sup></b>	<b>FTE</b>	<b>Total Extended Annual Salary</b>
<b>1998</b>	GS-13	\$60,583	\$80,242	1.0	\$80,242
	GS-11	\$42,509	\$56,303	14.0	\$788,244
	GS-5	\$23,188	\$30,713	5.0	\$153,563
	GS-4	\$20,726	\$27,452	0.5	\$13,726
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
	<b>Total</b>			<b>21.5</b>	<b>\$1,084,829</b>
<b>1999</b>	GS-13	\$60,583	\$80,242	1.0	\$80,242
	GS-11	\$42,509	\$56,303	14.0	\$788,244
	GS-7/step 1	\$25,341	\$33,564	5.0	\$167,821
	GS-4	\$20,726	\$27,452	0.5	\$13,726
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
	<b>Total</b>			<b>21.5</b>	<b>\$1,099,088</b>
<b>2000</b>	GS-13/step 6	\$62,365	\$82,602	1.0	\$82,602
	GS-12/step 1	\$44,953	\$59,540	14.0	\$833,563
	GS-9/step 1	\$31,000	\$41,060	5.0	\$205,298
	GS-4/step 6	\$21,336	\$28,260	0.5	\$14,130
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
	<b>Total</b>			<b>21.5</b>	<b>\$1,184,648</b>
<b>2001</b>	GS-13/step 6	\$62,365	\$82,602	1.0	\$82,602
	GS-12/step 1	\$44,953	\$59,540	14.0	\$833,563
	GS-11/step 1	\$37,507	\$49,678	5.0	\$248,390
	GS-4	\$21,336	\$28,260	0.5	\$14,130
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
	<b>Total</b>			<b>21.5</b>	<b>\$1,227,740</b>
<b>2002/03</b>	GS-13/step 7	\$64,147	\$84,963	1.0	\$84,963
	GS-12/step2	\$46,452	\$61,526	14.0	\$861,359
	GS-12/step 1	\$44,953	\$59,540	5.0	\$297,701
	GS-4/step 7	\$21,946	\$29,067	0.5	\$14,534
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
	<b>Total</b>			<b>21.5</b>	<b>\$1,307,612</b>

<b>2004/05</b>	GS-13/step 8	\$65,929	\$87,323	1.0	\$87,323
	GS-12/step 3	\$47,951	\$63,511	14.0	\$889,155
	GS-12/step 2	\$46,452	\$61,526	5.0	\$307,628
	GS-4/step 8	\$22,556	\$29,875	0.5	\$14,938
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
			<b>Total</b>	<b>21.5</b>	<b>\$1,348,099</b>
 <b>2006/07</b>	GS-13/step 9	\$67,710	\$89,682	1.0	\$89,682
	GS-12/step 4	\$49,449	\$65,495	14.0	\$916,933
	GS-12/step 3	\$47,951	\$63,511	5.0	\$317,555
	GS-4/step 9	\$23,166	\$30,683	0.5	\$15,342
	E-7/MSGT <sup>4</sup>	\$27,309	\$49,054	1.0	\$49,054
			<b>Total</b>	<b>21.5</b>	<b>\$1,388,566</b>

**Figure A-8: Projected Personnel Cost Savings for Proposed Call  
Center Staffing Structure**

<b>Fiscal Year</b>	<b>Current</b>	<b>Proposed</b>	<b>Savings</b>
<b>1998</b>	\$1,254,225	\$1,084,829	\$169,396
<b>1999</b>	\$1,254,225	\$1,099,088	\$155,138
<b>2000</b>	\$1,289,618	\$1,184,648	\$104,971
<b>2001</b>	\$1,289,618	\$1,227,740	\$61,878
<b>2002</b>	\$1,325,041	\$1,307,612	\$17,429
<b>2003</b>	\$1,325,041	\$1,307,612	\$17,429
<b>2004</b>	\$1,359,885	\$1,348,099	\$11,786
<b>2005</b>	\$1,359,885	\$1,348,099	\$11,786
<b>2006</b>	\$1,394,730	\$1,388,566	\$6,164
<b>2007</b>	\$1,394,730	\$1,388,566	\$6,164

Figure A-9: Present Value of Projected Call Center Costs with Current Staffing Structure and Configuration

Project Year Fiscal Year	0 1997	1 1998	2 1999	3 2000	4 2001	5 2002	6 2003	7 2004	8 2005	9 2006	10 2007
<b>Non-Recurring Costs</b>											
Operational Space											
Design	\$12,697										
Equipment											
Telecommunications <sup>1</sup>	\$43,050										
Technical Support											
Private Consultants	\$182,720										
Government Agencies	\$32,725										
<b>Total Non-Recurring Costs</b>	<b>\$271,192</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
<b>Recurring Costs</b>											
Operations & Maintenance											
GSA Building	\$38,089	\$38,089	\$38,089	\$38,089	\$38,089	\$38,089	\$38,089	\$38,089	\$38,089	\$38,089	\$38,089
Telecommunications <sup>2</sup>	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000	\$12,000
Personnel											
Salaries & Benefits	\$1,254,225	\$1,254,225	\$1,254,225	\$1,289,618	\$1,289,618	\$1,325,041	\$1,325,041	\$1,359,885	\$1,359,885	\$1,394,730	\$1,394,730
<b>Total Recurring Costs</b>	<b>\$1,304,314</b>	<b>\$1,304,314</b>	<b>\$1,304,314</b>	<b>\$1,339,707</b>	<b>\$1,339,707</b>	<b>\$1,375,130</b>	<b>\$1,375,130</b>	<b>\$1,409,974</b>	<b>\$1,409,974</b>	<b>\$1,444,819</b>	<b>\$1,444,819</b>
<b>Total Costs</b>	<b>\$1,575,506</b>	<b>\$1,304,314</b>	<b>\$1,304,314</b>	<b>\$1,339,707</b>	<b>\$1,339,707</b>	<b>\$1,375,130</b>	<b>\$1,375,130</b>	<b>\$1,409,974</b>	<b>\$1,409,974</b>	<b>\$1,444,819</b>	<b>\$1,444,819</b>
<b>Present Value<sup>3</sup> of Total Costs</b>											
5 years	\$7,029,835										
10 years	\$11,165,180										

<sup>1</sup> Includes ACD portion of telecommunications upgrade.

<sup>2</sup> Estimate from Bentley Report, 30 June 1997.

<sup>3</sup> 7% discount rate.

[illegible]

Includes new ceiling, carpeting, painting, wall coverings, partition construction, glass viewing wall, electrical service to 20 workstations, cat 5 com and data lines from the com closet to the HVAC ducting to the renovation designed prints, minor relocation of existing equipment that conflicts with DLSC submitted prints.

<sup>2</sup> Includes ACD portion of telecommunications upgrade.

<sup>3</sup> Estimate based on DSCC purchases.

\* Assumes upgrade of comparable hardware/software in 6th year of project.

**Includes LED Map Board.**

<sup>5</sup> Estimate from Bentley Report, 30 June 1997.

<sup>7</sup> Estimate based on expected maintenance costs at FISC.

<sup>3</sup> Estimate from Bentley Report, 30 June 1997.

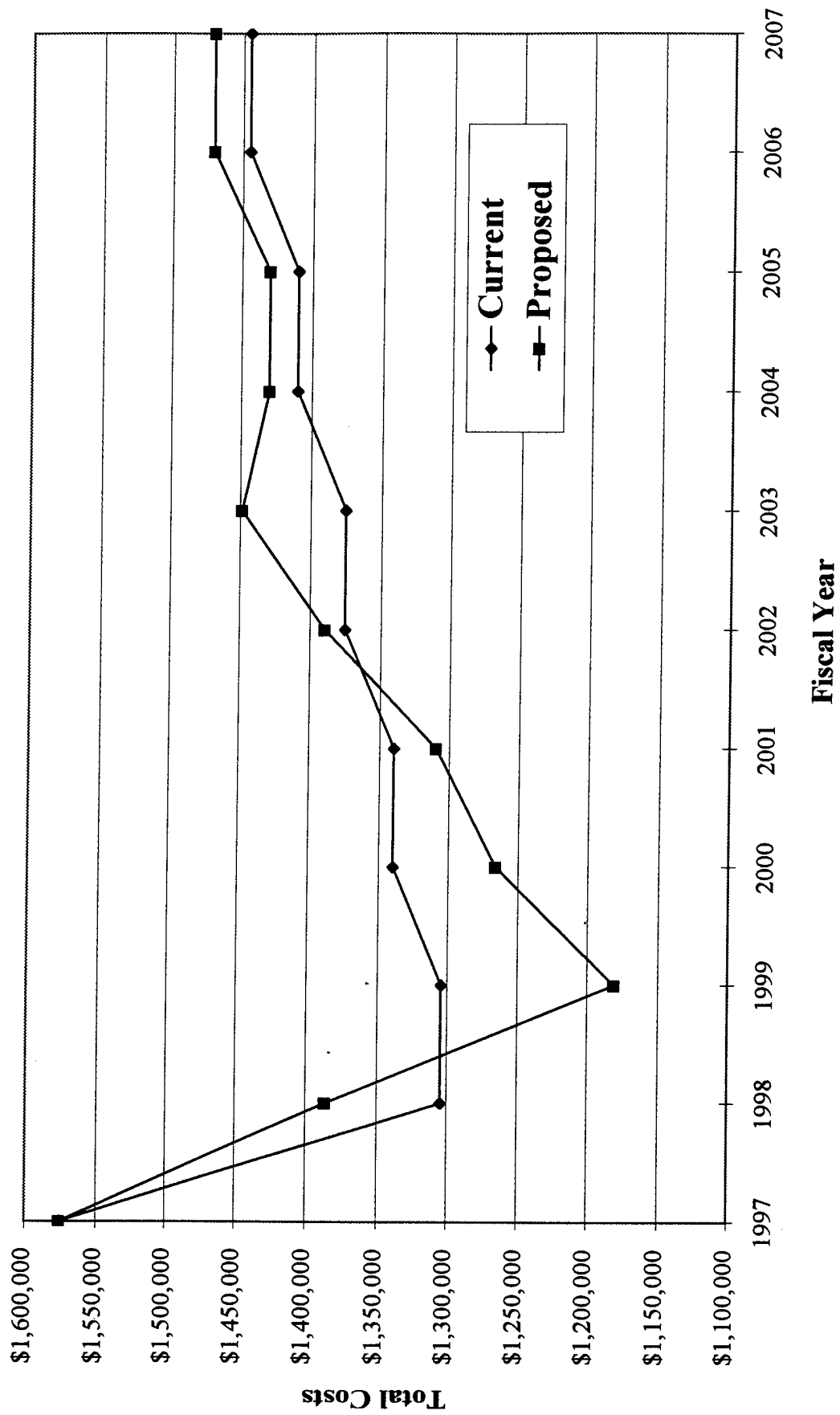
7% discount rate.

**Figure A-11: Projected Total Costs of Current and Proposed Call Centers**

<b>Project</b>	<b>Fiscal</b>	<b>Total Costs</b>			<b>Discount</b>	<b>Present</b>	
<b>Year</b>	<b>Year</b>	<b>Current</b>	<b>Proposed</b>	<b>Difference</b>	<b>Factor<sup>1</sup></b>	<b>Value</b>	<b>Total</b>
0	1997	\$1,575,506	\$1,575,506	\$0	1.0000	\$0	
1	1998	\$1,304,314	\$1,386,191	(\$81,876)	0.9346	(\$76,520)	
2	1999	\$1,304,314	\$1,180,803	\$123,512	0.8734	\$107,880	
3	2000	\$1,339,707	\$1,266,363	\$73,344	0.8163	\$59,871	
4	2001	\$1,339,707	\$1,309,455	\$30,252	0.7629	\$23,079	
<b>5</b>	2002	\$1,375,130	\$1,389,327	(\$14,197)	0.7130	(\$10,122)	<b>\$104,187</b>
6	2003	\$1,375,130	\$1,448,313	(\$73,183)	0.6663	(\$48,765)	
7	2004	\$1,409,974	\$1,429,814	(\$19,840)	0.6227	(\$12,355)	
8	2005	\$1,409,974	\$1,429,814	(\$19,840)	0.5820	(\$11,547)	
9	2006	\$1,444,819	\$1,470,282	(\$25,462)	0.5439	(\$13,850)	
<b>10</b>	2007	\$1,444,819	\$1,470,282	(\$25,462)	0.5083	(\$12,944)	<b>\$4,726</b>

<sup>1</sup> 7% discount factor.

**Figure A-12: Projected Total Costs of Current and Proposed Call**





**Figure A-13: Present Value of Proposed Call Center Cost Savings**

	<u><b>5 years</b></u>	<u><b>10 years</b></u>
<b>Current Call Center Costs</b>	\$7,029,835	\$11,165,180
<b>Proposed Call Center Costs</b>	\$6,925,648	\$11,160,454
<b>Present Value<sup>1</sup> of Savings</b>	\$104,187	\$4,726

<sup>1</sup> 7% discount rate

## **APPENDIX B**

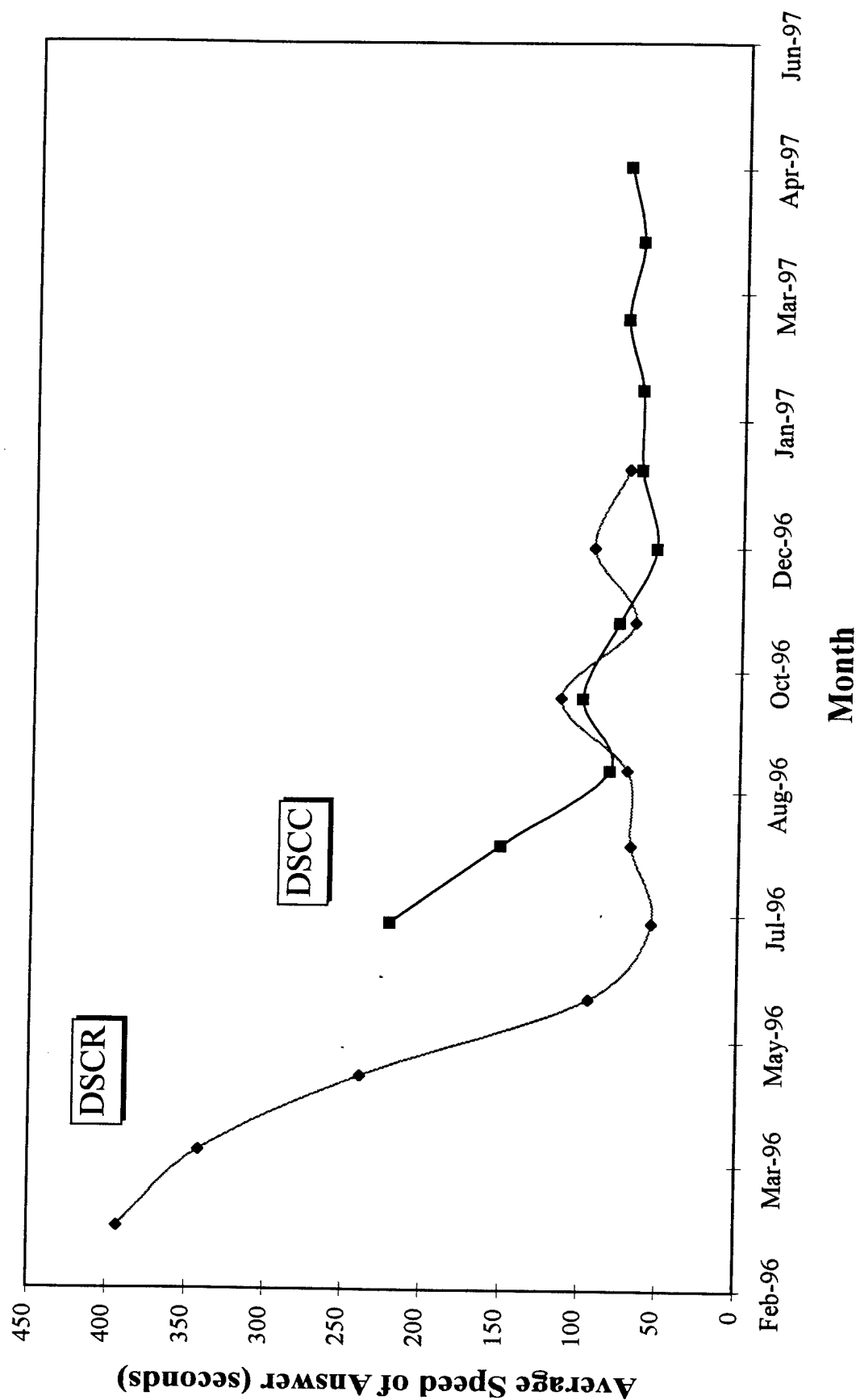
### **QUANTITATIVE BENEFITS**

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**Figure B-1: Average Speed of Answer (seconds) for DSCR and DSCC Call Centers**

<b>Month</b>	<b>DSCR</b>	<b>DSCC</b>
<b>Mar-96</b>	393	
<b>Apr-96</b>	342	
<b>May-96</b>	239	
<b>Jun-96</b>	95	
<b>Jul-96</b>	55	221
<b>Aug-96</b>	69	152
<b>Sep-96</b>	72	83
<b>Oct-96</b>	115	101
<b>Nov-96</b>	68	78
<b>Dec-96</b>	95	55
<b>Jan-97</b>	73	65
<b>Feb-97</b>		65
<b>Mar-97</b>		75
<b>Apr-97</b>		66
<b>May-97</b>		75
<b>11-month improvement</b>	<b>320</b>	<b>146</b>
<b>Percent improvement</b>	<b>81.4%</b>	<b>66.1%</b>

**Figure B-2: Average Speed of Answer (ASA) for DSCR and DSCC Call Centers**



**Figure B-3: Potential Labor Hour Savings for Call Center Customers**

	<u>CASC</u>	<u>DLSC CSO</u> <sup>1</sup>	<u>DLSC FOI</u> <sup>2</sup>	<u>DRMS</u>	<u>Total</u>
Daily Call Volume <sup>3</sup>	92.8	109.8	63.6	57.2	323.4
Weekly Call Volume <sup>4</sup>	464	549	318	286	1,617
Annual Call Volume <sup>5</sup>	23,200	27,450	15,900	14,300	80,850
Customer Labor Savings <sup>6</sup>					
Seconds/Year	5,405,600	6,395,850	3,704,700	3,331,900	18,838,050
Hours/Year	1,502	1,777	1,029	926	<b>5,233</b>

<sup>1</sup> DLSC Customer Service Office

<sup>2</sup> DLSC Freedom of Information Office

<sup>3</sup> Bentley Report, 30 June 1997.

<sup>4</sup> 5 days/week

<sup>5</sup> 50 weeks/year

<sup>6</sup> Based on average call duration improvement of 233 seconds/call.

**Figure B-4: Hourly Labor Rates for Call Center Customers**

<b>Customer</b>	<b>Grade</b>	<b>Basic Annual Rate</b>	<b>Total Annual Rate</b>	<b>Total Hourly Rate</b>
<b>Military</b>	E-2	\$12,033.19	\$23,486.74	\$11.29
	E-5	\$19,539.02	\$37,982.96	\$18.26
			<b>Average</b>	<b>\$14.78</b>
<b>Civilian</b>	GS-7	\$28,720.00	\$38,039.64	\$18.29
	GS-9	\$35,133.00	\$46,533.66	\$22.37
			<b>Average</b>	<b>\$20.33</b>

**Figure B-5: Potential Dollar Savings for Call Center Customers Based on Improvements in Average Call Duration**

	<u>CASC</u>	<u>DLSC CSO</u>	<u>DLSC FOI</u>	<u>DRMS</u>	<u>Total</u>
Total annual call volume	23,200	27,450	15,900	14,300	80,850
Total customer labor savings (hours)	1,502	1,777	1,029	926	5,233
Calls from military personnel <sup>1</sup>	13,920	16,470	9,540	8,580	48,510
Customer labor savings (hours)	901	1,066	617	555	3,140
Customer dollar savings <sup>2</sup>	\$13,313	\$15,751	\$9,124	\$8,206	\$46,393
Calls from civilian personnel <sup>3</sup>	9,280	10,980	6,360	5,720	32,340
Customer labor savings (hours)	601	711	412	370	2,093
Customer dollar savings <sup>4</sup>	\$12,211	\$14,448	\$8,369	\$7,526	\$42,553
Total customer dollar savings	\$25,523	\$30,199	\$17,492	\$15,732	<b>\$88,946</b>

<sup>1</sup> 60% of total.

<sup>2</sup> Based on \$14.78 hourly labor rate for military customers.

<sup>3</sup> 40% of total.

<sup>4</sup> Based on \$20.33 hourly labor rate for civilian customers.



**Figure B-6: Present Value of Potential Customer Benefits**

		<b>Potential</b>			
<b>Period</b>	<b>Fiscal Year</b>	<b>Customer Benefits<sup>1</sup></b>	<b>Discount Factor<sup>2</sup></b>	<b>Present Value</b>	<b>Total</b>
0	1997	\$0	1.0000	\$0	
1	1998	\$44,473	0.9346	\$41,564	
2	1999	\$88,946	0.8734	\$77,689	
3	2000	\$88,946	0.8163	\$72,607	
4	2001	\$88,946	0.7629	\$67,857	
<b>5</b>	2002	\$88,946	0.7130	\$63,417	<b>\$323,134</b>
6	2003	\$88,946	0.6663	\$59,269	
7	2004	\$88,946	0.6227	\$55,391	
8	2005	\$88,946	0.5820	\$51,768	
9	2006	\$88,946	0.5439	\$48,381	
<b>10</b>	2007	\$88,946	0.5083	\$45,216	<b>\$583,158</b>

<sup>1</sup> Assumes 50% of potential annual benefits achievable in first year of project.

<sup>2</sup> At 7% discount rate.

**Figure B-7: Net Present Value of Projected Costs and Benefits**

	<u>5 years</u>	<u>10 years</u>
<b>Current Call Center Costs</b>	\$0	\$0
<b>Proposed Call Center Costs</b>	\$0	\$0
<b>Cost Savings</b>	\$0	\$0
<b>Potential Customer Benefits</b>	\$323,134	\$583,158
<b>Net Present Value<sup>1</sup></b>	\$323,134	\$583,158

<sup>1</sup> 7% discount rate

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## **APPENDIX C**

### **SENSITIVITY ANALYSIS**

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Figure C-2: Present Value of Projected Customer Benefits with Increased Call Duration Improvement and Increasing Call Volume

Call Duration Improvement (seconds) Change in Call Volume											
Project Year Fiscal Year	0	1	2	3	4	5	6	7	8	9	10
	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07
Daily Call Volume	323.4	339.6	356.5	374.4	393.1	412.7	433.4	455.1	477.8	501.7	526.8
Weekly Call Volume	1,617	1,698	1,783	1,872	1,965	2,064	2,167	2,275	2,389	2,508	2,634
Annual Call Volume	80,850	84,893	89,137	93,594	98,274	103,187	108,347	113,764	119,452	125,425	131,696
Potential Customer Labor Savings (hours)	-	3,434	7,211	7,572	7,951	8,348	8,766	9,204	9,664	10,147	10,655
Potential Customer Dollar Savings	\$0	\$58,378	\$122,594	\$128,724	\$135,160	\$141,918	\$149,014	\$156,465	\$164,288	\$172,503	\$181,128
Present Value <sup>1</sup> of Potential Benefits											
5 years	\$471,014										
10 years	\$949,271										

<sup>1</sup> 7% discount rate

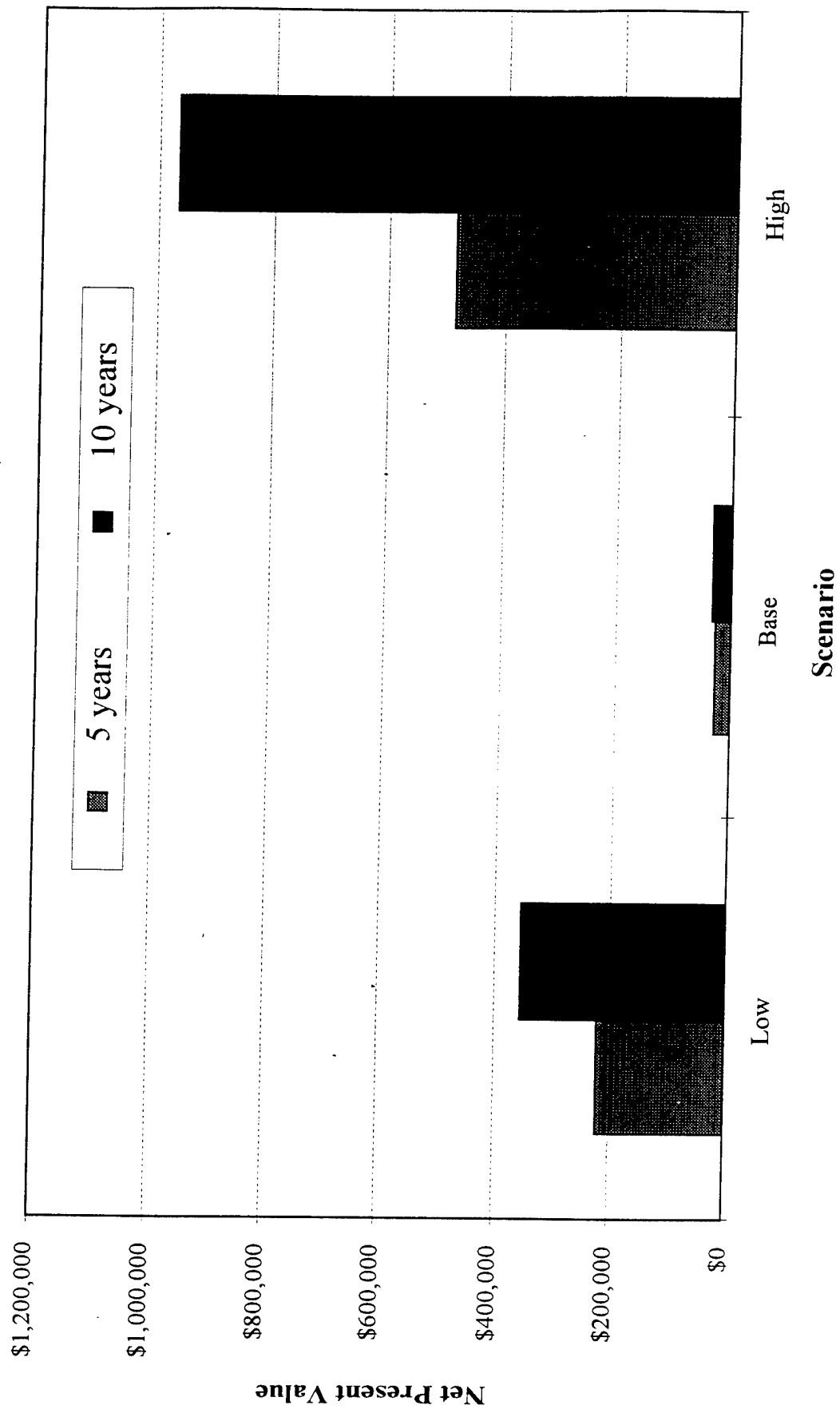
**Figure C-3: Net Present Value of Projected Cost Savings and Benefits under Low, Base, and High Scenarios**

	<u>Low</u>	<u>Base</u>	<u>High</u>
Call Duration Improvement (seconds)	175	233	291
Call Volume Change	-5%	-	5%
Present Value of Potential Benefits			
5 years	\$207,170	\$13,313	\$471,014
10 years	\$337,805	\$15,751	\$949,271
Net Present Value <sup>1</sup>			
5 years	\$221,090	\$27,233	\$484,934
10 years	\$354,275	\$32,221	\$965,741

<sup>1</sup> At 7% discount rate. Includes present value of projected cost savings.



**Figure C-4: Net Present Value of Projected Cost Savings and Benefits**



## **APPENDIX D**

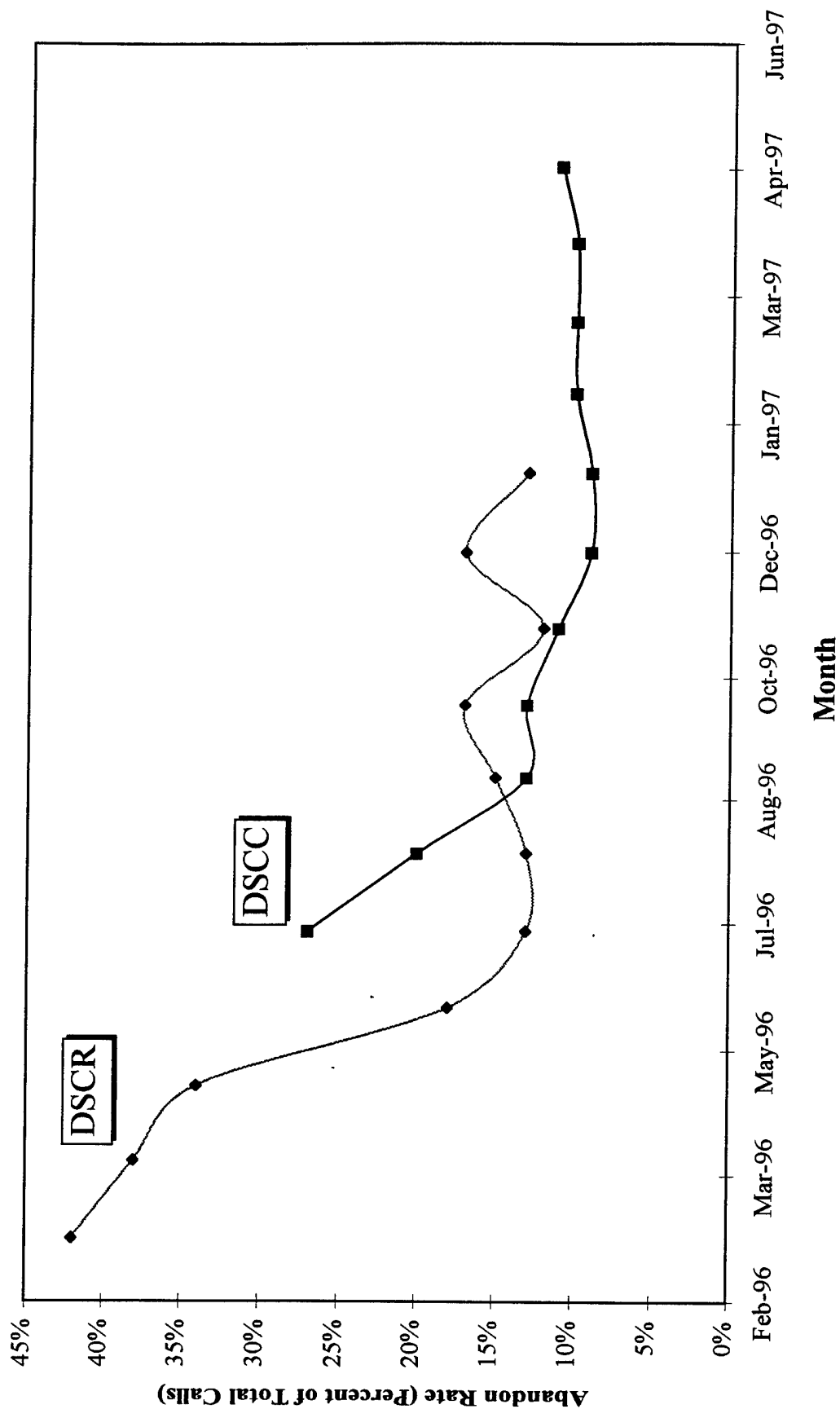
### **QUALITATIVE BENEFITS**

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**Figure D-1: Abandon Rate (Percent of Total Calls) for DSCR and DSCC**

<b>Month</b>	<b>DSCR</b>	<b>DSCC</b>
<b>Mar-96</b>	42%	
<b>Apr-96</b>	38%	
<b>May-96</b>	34%	
<b>Jun-96</b>	18%	
<b>Jul-96</b>	13%	27%
<b>Aug-96</b>	13%	20%
<b>Sep-96</b>	15%	13%
<b>Oct-96</b>	17%	13%
<b>Nov-96</b>	12%	11%
<b>Dec-96</b>	17%	9%
<b>Jan-97</b>	13%	9%
<b>Feb-97</b>		10%
<b>Mar-97</b>		10%
<b>Apr-97</b>		10%
<b>May-97</b>		11%
<b>11-month improvement</b>	29%	16%

**Figure D-2: Abandon Rate for DSCR and DSCC Call Centers**



**Figure D-3: First Call Resolution for DSCR and DSCC Call Centers**

<b>Month</b>	<b>DSCR<sup>1</sup></b>	<b>DSCC</b>
<b>Jul-96</b>	-	71%
<b>Aug-96</b>	-	72%
<b>Sep-96</b>	-	74%
<b>Oct-96</b>	69%	72%
<b>Nov-96</b>	66%	71%
<b>Dec-96</b>	72%	69%
<b>Jan-97</b>	70%	69%
<b>Feb-97</b>	71%	68%
<b>Mar-97</b>	-	72%
<b>Apr-97</b>	89%	72%
<b>May-97</b>	90%	73%

<sup>1</sup> Telecommunications upgrade in March 1997.

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## **APPENDIX E**

### **GLOSSARY OF TELECOMMUNICATION TERMS**



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## GLOSSARY OF TELECOMMUNICATION TERMS

AC	alternating current
ACD	automatic call distributor
ACR	attenuation to crosstalk ratio
ADSL	asymmetric digital subscriber line
AIN	advanced intelligent network
ANI	automatic number identification
API	application programming interface
ASCII	American standard code for information interchange
ATM	asynchronous transfer mode
AUI	autonomous (or attachment) unit interface
AWG	American wire gauge
BPV	bipolar variations
BRI	basic rate interface
CAD/CAM	computer aided design/computer aided manufacturing
CAP	competitive access provider
CATV	cable television
CBF	computer-based fax
CBX	computerized branch exchange
CCTV	closed circuit television
CDDI	copper distributed data interface
CDMA	code division multiple access
CDPD	cellular digital packet data
CDR	call detail recording
CICS	customer information control system
CIS	customer information system
CO	central office
CPE	customer-provided equipment
CPU	central processing unit
CRC	cyclical redundancy checking
CSMA/CD	carrier sense multiple access with collision detection
CSU/DSU	channel service unit/data service unit
CTI	computer telephony integration
dB	decibels
DCE	data communications equipment
DDS	digital data system
DES	data encryption standard
DID	direct inward dialing
DIP	dual in-line package
DNIS	dialed number identification system
DOS	disk operating system

DS	direct sequence
DSL	digital subscriber line
DSX	digital system cross-connect frame
DTE	data terminal equipment
E1	European version of North American T1; at 2.048 Mb/s.
EC	electronic commerce
ECTF	enterprise computer telephony forum
EDI	electronic data exchange
EIA	electronic industries association
ELEC	enterprise local exchange carrier
EMI	electromagnetic interference
FCC	Federal Communications Commission
FDDI	fiber distributed data interface
FH	frequency hopping
FRAD	frame relay access devices
FTP	file transfer protocol
GB	gigabyte; one billion bits
GB/s	one billion bits per second
GHz	gigahertz; one billion hertz
GIF	graphics interface format
GPS	global positioning system
GSM	global standard for mobile communications
GUI	graphical user interface
HDSL	high-speed digital subscriber line
HTML	hyper text markup language
HTTP	hyper text transfer protocol
ICR	intelligent call router
ID	identification
IEEE	institute of Electrical and Electronic Engineers
IEN	integrated enterprise network
IP	Internet protocol
IPX	Internet packet exchange
IS	information systems
ISA	industry standard architecture
ISDN	integrated services digital network
ISM	industrial scientific medical
IT	information technology
IVR	interactive voice response
IX	interexchange
IXC	interexchange carrier
kb/s	kilobits per second; one thousand bits per second

kV	kilovolts; one thousand volts
LAN	local area network
LATA	local access and transport area
LCD	liquid crystal display
LDAP	lightweight directory access protocol
LEC	local exchange carrier
LED	light emitting diode
LLC	logical link control
MAN	metropolitan area network
MAU	math acceleration (or multistation access) unit
MB	megabytes; one million bytes
Mb/s	megabits per second; one million bits per second
MCU	multipoint control (or multipoint conferencing) unit
MHz	megahertz; one million hertz
MIS	management information systems
MMDS	multichannel microwave distribution service
NANP	North American numbering plan
NBO	networked business objects
NEXT	near-end crosstalk
NOS	network operating system
NT	new technology, usually known as Windows NT
OAM	operations, administration, and maintenance
OCR	optical character recognition; or outgoing call restriction
OS/2	operating system/2
OSI	open systems interconnection
OTDR	optical time domain reflectometer
PACS	personal access communications service
PAP	packet-level procedure
PBX	private branch exchange
PC	personal computer
PCI	peripheral component interconnect
PCMCIA	personal computer memory card international association
PCS	personal communications service
PDA	personal digital assistant
PDU	protocol data unit
PIN	personal identification number
POF	plastic optical fiber
PPP	point-to-point protocol
PRI	primary rate interface
PSTN	public switched telephone network
PTT	post telephone and telegraph administration

RAM	random access memory
RBOC	regional Bell operating company
RF	radio frequency
RFI	radio frequency interference
RMON	remote monitoring
ROM	read only memory
SCADA	supervisory control and data acquisition
SCS	structured cabling system
SDLC	synchronous data link control
SDSL	symmetric digital subscriber line
SMDR	station message detail reporting
SMDS	switched megabit (or multimegabit) data services
SMTP/MIME	simple mail transport protocol and multipurpose Internet mail extensions
SNA	systems network architecture
SNMP	simple network management protocol
SPX	sequenced packet exchange
SQL	structured query language
SST	self-service terminal
STP	shielded twisted pair
T1	digital transmission link at 1.544 Mb/s (1,544,000 bits per second)
T3	28 T1 lines; 44.736 million bits per second
TAPI	telephony application programming interface
TCP/IP	transmission control protocol/Internet protocol
TDM	time division multiplexing
TDMA	time division multiple access
TFTP	trivial file transfer protocol
TSAPI	telephony services application programming interface
UHF	ultra high frequency
UPS	uninterruptible power supply
UTP	unshielded twisted pair
VAN	value-added network
VR	voice recognition
VRU	voice response unit
VSAT	very small aperture terminal
WAN	wide area network
WDM	wave division multiplexing
WLL	wireless local loop

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